PHYSIOGRAPHIC CONTROLS ON MAST SEEDING IN A SEMI-ARID CONIFER, PINYON PINE (*Pinus edulis*)

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Research Questions:

How do climatic, physiographic, and edaphic gradients influence seed cone production in *P. edulis*?

What conditions promote successful mast seed events in *P. edulis*?

Framework

Widespread regional mortality events[1] and documented declines of cone production[2] have raised questions regarding the sensitivity of reproduction dynamics to global climate change in this mast-seeding conifer- a keystone species in southwestern, semi-arid woodlands.

Previous research has demonstrated that cone production exhibits a negative relationship with late summer temperatures[2], suggesting a possible weather-related cue to initiate mast events.

Trends of increasing temperature and water stress may significantly influence reproductive output of *P. edulis* by altering resource availability[3], disrupting pollination phenology[4], and altering cues that initiate mast-seeding events[1,2].

Field Work

30 sites in Western Colorado and New Mexico (Fig. 1)

- Latitudinal range of *P. edulis*
- Elevation range of 4800 – 8000 ft.
- Gradient of soil types, climates, slopes, aspects

Cone scar abscission methodology (Fig. 2)

Stand characterization

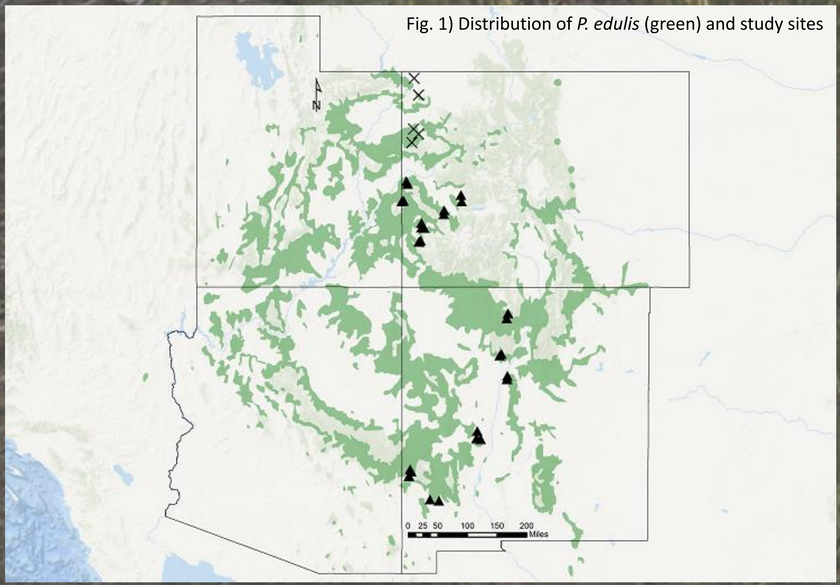
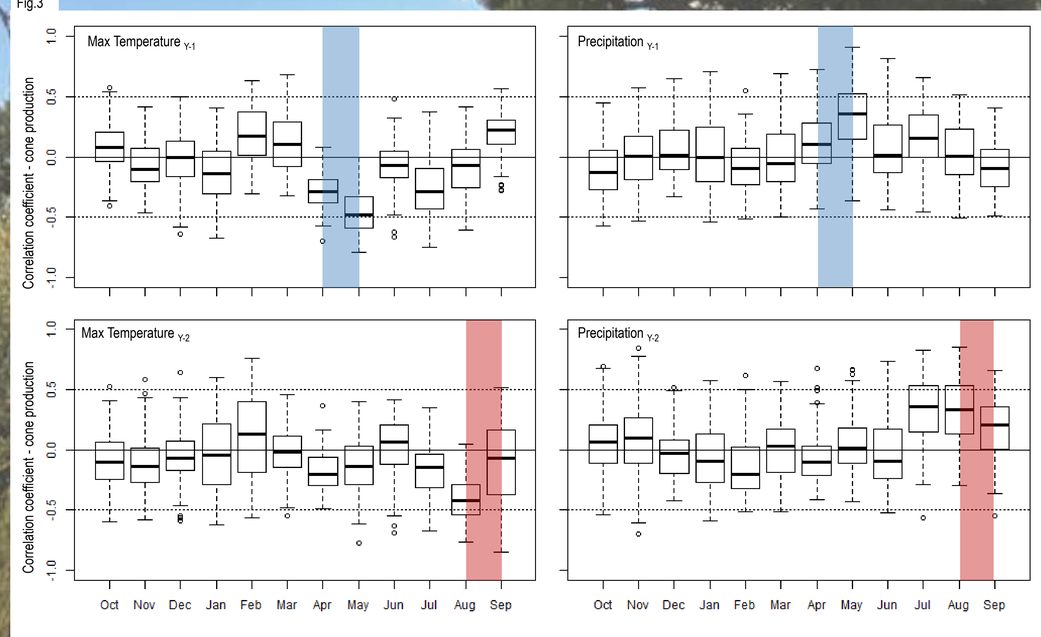


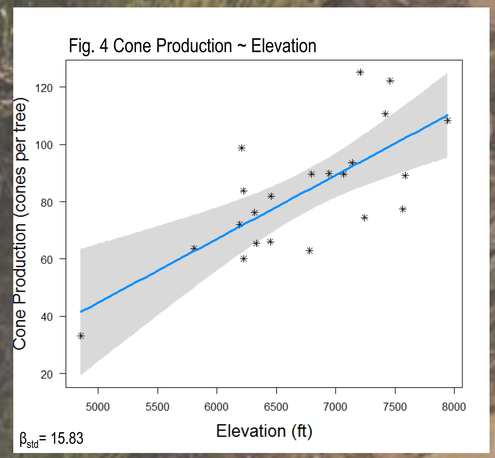
Fig. 1) Distribution of *P. edulis* (green) and study sites

Methods

- Monthly maximum temperature and mean precipitation data (via PRISM) for the 2 years prior to cone maturation was plotted against mean cone production at the tree-level using correlation matrices in R (Fig. 3).
- Red and blue bars denote the period of cone initiation in Y-2 and fertilization in Y-1.
- A linear model (*mean cone production ~ elevation + latitude + average basal area)* was built using the package lme4 in R.
- Partial residuals of elevation and latitude (Fig. 4 & 5) were plotted to visualize their relative contributing effects.

Fig.3





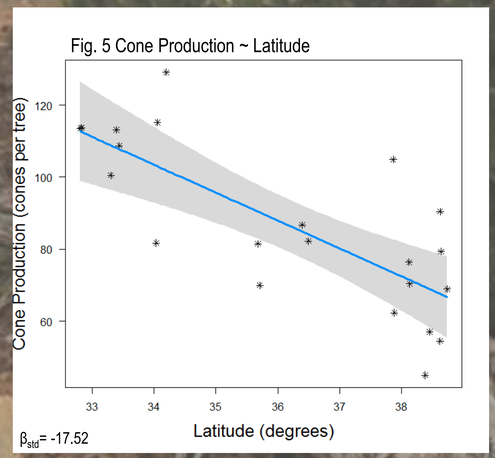


Fig. 2 (Photo from Redmond et al. 2016)

Results

- Cone production exhibits a positive relationship with elevation, and a negative relationship with latitude (R^2=.632, p=.0003).
- Max summer temperatures showed the strongest, negative effects for both years prior to cone maturation.
- Precipitation exhibits strong positive effects on cone production during the summer following cone initiation (Y-2), and spring prior to fertilization (Y-1).

Conclusions

- Results suggest both weather and physiography exert landscape-level controls over reproductive productivity.
- Consistent with previous research demonstrating negative relationship with cone production and late summer temperatures[2, 3], higher levels of productivity in high elevation stands[3].
- Demonstrates sensitivity of cone production to annual fluctuations in local weather and physiographic gradients.

References

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